

SCIENCE.

FRIDAY, MARCH 4, 1887.

COMMENT AND CRITICISM.

PROF. C. S. SARGENT, director of the Arnold arboretum of Harvard college, takes occasion to reverse some of his earlier advice, in an article printed in a recent report of the Massachusetts state board of agriculture on the subject of tree-planting. He had been, like most American writers on forestry, strongly impressed with the value of foreign trees for general cultivation in New England; but as imported trees grow older they do not fulfil the promise of their earlier years, and he has therefore become convinced that natives are better suited to our climate and soil than any exotics can be. The willow alone, of all foreign introduced trees, has qualities not possessed in a greater degree by some native. The European oak is perhaps the most unsatisfactory deciduous tree that has been experimented upon: it grows rapidly when young, but fails, when about twenty years old, from the cracking of the main stem, and then, after dragging out a wretched existence a few years longer, miserably perishes. The Scotch pine is a failure in New England as an ornamental or a timber tree: it perishes long before reaching maturity, and the discovery of its worthlessness has cost American planters something in money and a great deal in disappointed hopes. The Austrian and the Corsican pine seem to be no better. The Norway spruce has been for many years the most widely cultivated foreign tree in Massachusetts: it is cheap, easily transplanted, and grows rapidly and gracefully when young; but the general introduction of this tree into our plantations must, nevertheless, be regarded as a public misfortune. It must be acknowledged to be a complete failure in eastern America: it will never produce timber here, and it is decrepit and unsightly just at that period of life when trees should become really handsome in full development.

These facts cannot be generally appreciated, for Professor Sargent estimates that five foreign trees are now planted to one native. But some progress in native sylviculture has been made in the southeastern counties of Barnstable and Plymouth,

where the farmers have learned how to plant and raise forests successfully and profitably. "It has been demonstrated in Barnstable county that a crop of pitch-pine can be raised from seed with as much certainty as a crop of corn, and with much less expense; and that the loose and shifting sands of Cape Cod, useless for every other purpose, can, with the aid of this tree, be made to bear valuable crops of wood." There are also plantations of white-pine, dug as seedlings in the woods, made forty or fifty years ago in the barren, sandy, exhausted soil of Middleborough and Bridgewater. The young trees were set out in shallow furrows at odd times with little expense, and required no subsequent care. Men are now living in these towns who have cut and sold white-pine saw-logs at the rate of \$150 an acre, from seedlings set by themselves. These are no doubt the most successful and profitable attempts at sylviculture ever made in the United States; and, although the best methods of planting are not yet so fully understood as in the case of the pitch-pine, the experiments show that the white-pine, the most valuable trees in New England, can be cultivated with success and profit.

The supply of railroad-ties is a matter of growing importance for the New England farmer, and certain experiments made at the suggestion of Professor Sargent by the Boston and Providence railroad have an important bearing on it. Fifty-two ties were laid in December, 1878, on a track in Boston where the traffic is very heavy, having an average of sixty-five trains daily. Ten kinds of wood were tried, five in the natural state and five creosoted. None of the ties rotted, except one of the ailantus: the others that had to be removed had been injured by the hammering of the trains. Spruce, hemlock, larch, and southern pine have all suffered badly in this way. White-oak lasted well, but it holds the spikes so firmly that they cannot be drawn when the rails have to be shifted. Creosoted elm and birch did well, and are to be recommended. Chestnut was unfortunately not included in the experiment, although it is considered one of the best woods for ties. The behavior of the catalpa was one of the most interesting fea-

tures of the case : it has been highly spoken of for ties on account of its practical indestructibility when placed in the soil, and all the ties of this wood here tried are still sound, except just under the rails, where they are crushed nearly to pulp, so as to be of no service whatever for roads of heavy traffic.

IN A RECENT number of *Science* we noted some instances in which large employers had given favorable testimony to the action of profit-sharing in promoting good feeling and harmonious relations between employers and employees. The reverse side is presented very forcibly and clearly by Mr. Richard Aldrich in the *Quarterly journal of economics*. Mr. Aldrich points out that any system, such as profit-sharing or industrial partnership, which promises so momentous results, must be subjected to a most careful examination before receiving the stamp of approval. The inductive evidence so far obtained, he contends, is not sufficient, because the data included in it are so few, the whole number of instances collected not being more than one hundred,—a very minute speck in the whole world of business. Furthermore, the actual application of the system of profit-sharing has been so limited that the cases, from their very novelty, have often been surrounded by a set of special circumstances, and to eliminate the effect of these a large number of cases must be averaged. Induction being, for the present, inconclusive, it is necessary to turn to theoretical and *a priori* considerations. In applying these, in turn, profit-sharing must be viewed as a permanent and prevalent industrial system, and not as exceptional and experimental. Then the first consideration is that profit-sharing is unfair, in that it disturbs the natural working of wages and pays the employee twice over—his insured part of the product represented by wages, and a premium besides. The latter is taken from what should accrue to capital, and is over and above the commuted and fixed advanced share of the product, to which alone the employee is entitled.

Furthermore, profit-sharing implies some profits to share ; but what happens, Mr. Aldrich asks,—and this is a point we have frequently emphasized in *Science*,—if instead of a profit there should be a loss ? Logically, profit-sharing must and does imply loss-sharing. But this is impossible, and while capital is asked to share prosperity, it must

shoulder adversity alone. It, of course, suggests itself that a reserve fund might be established in good years to be used in bad ones, but there are practical objections to this. In the first place, the stimulus to the employee which profit-sharing is supposed to furnish by holding out a prospect of immediate gain, is blunted by any claim on the gross profits other than the necessary ones of interest on capital, and profit on the same ; and, secondly, the exact amount of the reserve fund would be difficult to determine. Another and a very forcible objection to profit-sharing is, that, in order to protect the employees, a full publication of the accounts of the business would be necessary. This would render business impossible. Secrecy in accounts is a most important element in the security and stability of any business, however sound. Mr. Aldrich develops all these considerations somewhat, and then mentions the very interesting and suggestive point, hitherto generally overlooked, that, because of the importance of the *entrepreneur* in the modern industrial system, the result of the widely-spread adoption of industrial partnerships would be to subordinate the pay of the laborer to the success of the capitalist who employs him. Where capital plays a subordinate part, where the functions of the *entrepreneur* are reduced to a minimum, there will industrial partnership be applied with greatest chance of success. But suppose, says Mr. Aldrich, that profit-sharing does all that is claimed for it by its advocates, and is introduced generally, in what respect will the situation of labor and capital be changed ? The satisfactory results now attested to are due to the present exceptional character of the system. “The glamour and emotional interest which surround the experiments in industrial partnership have prevented any practical test from ever yet being made that would give the system an undoubted claim to be considered a solution of the ‘labor problem.’”

THE DENTISTS OF MASSACHUSETTS are again endeavoring to secure a legislative act establishing a board of registration in dentistry. Such an act almost became a law several years ago, and seems to have failed because it was regarded by some as an infringement of the liberties and rights of the people, or on that small share of them who wished to practise dentistry without sufficient previous study. A broader view of the question would give chief consideration to the feelings of those

who are practised upon, and it is to be hoped that this view may now prevail. Twenty-seven of our states already have laws that close the profession of dentistry to men not properly fitted for it, so that Massachusetts has become, as it were, an asylum for the unskilled, and is already flooded with them, thereby working great hardship on the educated and capable members of the profession. Good reasons against such regulation as the Massachusetts legislature is now considering, are difficult to discover.

In the same line as this, but in a less advanced stage, is a move in Pennsylvania to allow the prescription of spectacles only to properly instructed oculists, and withhold it from opticians, whose duties end with supplying the glasses that have been prescribed. We could adduce here the same arguments that uphold the propriety of permitting none but physicians to prescribe medicines, while druggists may compound the medicines thus prescribed; while the objections to the proposition would come only from those who accept the not uncommon impression, encouraged by most opticians, that the choice of suitable glasses is not a difficult matter. This is true enough in many simple cases; but every oculist can quote examples of harmful effects following the use of lenses not adapted to the needs of the eyes. Few opticians have more than a mechanical training in their art, while the oculist should be a specialized physician. He and his patients deserve the same protection that is extended to other doctors and theirs.

BY THE WILL of the late Uriah A. Boyden, property, the present value of which exceeds two hundred and thirty thousand dollars, was left in trust for the purpose of astronomical research "at such an elevation as to be free, so far as practicable, from the impediments to accurate observations which occur in the observatories now existing, owing to atmospheric influences." The trustees of this fund have transferred the property to the President and fellows of Harvard college, in order that the researches proposed by Mr. Boyden may be directed at the Harvard college observatory. These researches will be supported by a portion of the means of the observatory, in addition to the trust-fund itself. The establishment and general management of the proposed mountain observatory will form a part of the work done

at Cambridge, where also the observations made at the new station will in general be reduced and prepared for publication.

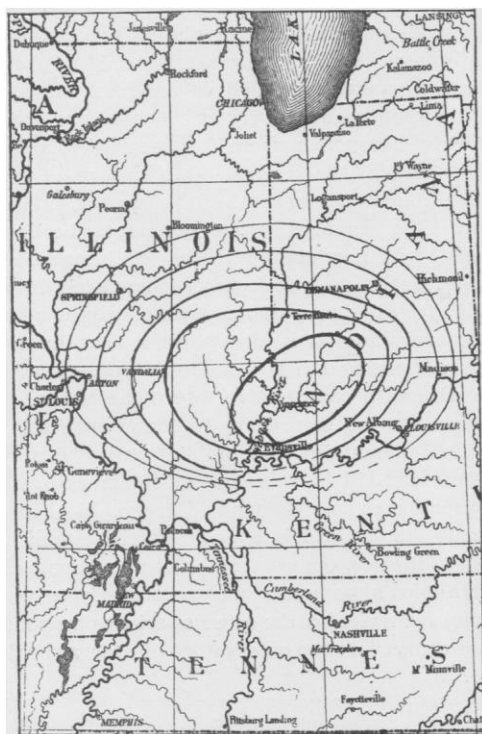
This donation opens a new field to astronomical activity. Heretofore the establishment of observatories has depended upon local or personal influences, which have usually confined them to the neighborhood of large cities, obviously not the best situation for astronomical work. The new observatory can be placed in what may appear, after sufficient inquiry and experiment, to be the best attainable location. Many obvious reasons suggest the selection of some place in the southern hemisphere. The southern heavens are still comparatively unknown, much as has been effected during the present century by the southern expeditions of astronomers from Europe and the United States, and by the gradual establishment of permanent observatories south of the equator. Moreover, if the present observatory of Harvard college is aided by a new station in the southern hemisphere, a scheme of work may be planned at Cambridge for the survey of the entire heavens upon a uniform plan. It is also probable that the stations combining the advantages of the greatest elevation with comparative ease of access and a climate not too severe may be found upon some southern mountains. Before the project can be executed, it will be necessary to obtain as much information as possible upon all geographical and climatic topics which may affect the establishment of the new observatory. All who have such information at command will accordingly be rendering a service to the cause of science by communicating it to the observatory of Harvard college.

THE INDIANA EARTHQUAKE.

THE U. S. geological survey has received information from about seventy towns within, and adjacent to, the area shaken by the earthquake of Feb. 6, 1887, in Indiana and Illinois. The accompanying map shows the derived isoseismal lines numbers 2 to 6 on the Rossi-Forel scale of intensity. The survey is greatly indebted to Prof. T. C. Mendenhall of Terre Haute for his courtesy in distributing printed letters of inquiry, and it is mainly from the replies to these letters that the data have been obtained. The only exact time-observation also was made by him with a seismoscope connected with a clock. The time he gives was 4^h 15^m 6^s reduced to the 90th meridian

The disturbed area embraces about 35,000 square miles, and is elliptical in shape, the major axis lying nearly east and west. It is limited to the southward by the valley of the Ohio, and was but slightly felt south of the river. The reported directions of movement are, as usual, very inconsistent and of little value. It is generally reported that two distinct shocks were felt, each of a few seconds' duration, and with a small but very noticeable interval between them. A low rumbling was also generally observed as preceding and accompanying the shocks.

With the exception of Professor Mendenhall's



THE INDIANA EARTHQUAKE.

observation, the times given are not accurate enough to be of much utility. Coseismal lines, therefore, cannot be obtained for this earthquake. The speed with which a shock travels is so great, and the area and distances, relatively speaking, are so small, that it would require numerous time-determinations of very great precision to warrant any attempt to fix the coseismals.

Mr. Everett Hayden has 'weighed' the intensities, and has plotted, with his usual care and intelligence, the isoseismals herewith given. The closed curves are neither symmetric nor co-axial, and this seems to be certainly attributable, not to

uncertainties of the reports alone, but to real asymmetry in the distribution of the force of the shocks, and to a real shifting of the axes of the figures as the elastic waves of energy spread out. It is not easy to make any comparison between this earthquake and others which from time to time occur in the valley of the Ohio, for it is the only case since the New Madrid earthquakes of 1811-12 when definite data in sufficient quantity have been gathered which would serve as the basis of such an estimate. In a general way, it may be said, however, that the intensity of the disturbance in the central portions was, on the whole, about equal to that exerted in the southern portion of Ohio, central Tennessee, and Kentucky by the Charleston earthquake of Aug. 31, 1886.

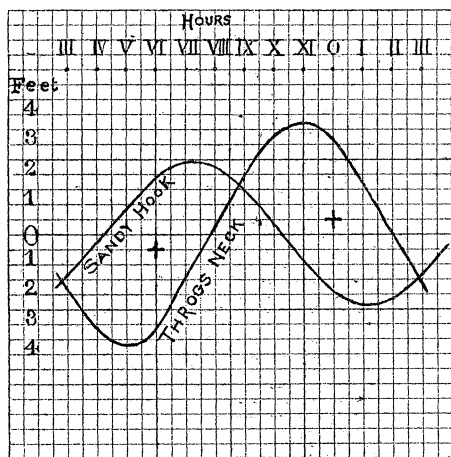
CIRCULATION OF THE SEA THROUGH NEW YORK HARBOR.

Two derivations of the tide enter New York harbor, one by way of Long Island Sound, the other by way of Sandy Hook Bar. The one that traverses the sound is much obstructed and 'crowded,' so that it arrives upon the scene four hours behind the other, and much augmented in 'range.'

These two tides meet, or pass into each other, at Hell Gate, and give to the city portion of the East River a composite 'rise-and-fall' and a peculiarly local system of tidal currents. The general scheme of this meeting and composition is to be found in the annual report of the coast survey for 1867, much as I should give it to-day, so I will not enter upon it here, but offer the accompanying diagram as the types of the tidal profiles.

The two figures are serpentine curves whose elements are those of the tides given in the tables of published charts for the two entrances to New York. From this diagram we observe that about three lunar hours after the moon's transit, the surface of the sound is at the same elevation as the sea at Sandy Hook. Later, they differ, and more and more widely, till at the sixth hour a maximum difference of height is reached, which exceeds five feet. Then a decline takes place, till at the ninth hour the sound and Sandy Hook Bay are again upon the same level. After this a slope in the opposite sense develops, reaching a maximum about the time of the next transit. The first slope, that between three hours and nine, is towards the sound, i.e., the sound continues through this interval to be lower than the harbor. The second slope is towards the harbor, and one may remember it easily as that which reaches its maximum at the 'southing of the moon,' and creates the 'ebb-current,' so called.

Referring again to the diagram, it will be seen that the two lunes, or spaces between the type-curves, are equal, i.e., the slopes creating the flood-current and the ebb-current, alternately, are equal in amount and duration. There is the same 'head' for one stream as for the other. But there is a very important difference in the positions of these lunes, which affects materially the relative values of the slopes they represent. I have marked with a cross the centre of each, and it will be observed that the right-hand lune is one foot above the other, — which means that the ebb (westerly) current is in deeper water and greater transverse section than the flood. It is, therefore, the larger stream, and, having greater 'hydraulic mean depth,' it is at most points the quicker also. The East River is delivering more water into New



York harbor than it carries back again to the sound.

Although the Hudson and other rivers flow into New York harbor, and slightly raise its level, the conditions illustrated in our diagram are very nearly realized in the seasons when the fresh-water discharge is at a minimum. One of these seasons is the autumn; the other is mid-winter, when the land-waters are ice-bound. At such times, the greater velocity being westward, and the greater depth of water being that of the westerly flow, there is, as a net result, a circulation of sea-water through the harbor from the sound to the ocean. In mid-winter this circulation, renewing the water before it can get chilled, and lowering the freezing-point, by mixing sea-water with the river discharge, serves to keep the port open to commerce. One may form some estimate of the value of the three or four degrees difference of freezing-points

between sea and river waters, when it is remembered that in severe winters Halifax, Portland, and Boston have not closed before Philadelphia or even Baltimore.

This circulation also aids in maintaining the channels over the bar, which could not exist if the ebb and flood were equal, i.e., if there were no 'net-gain' of the sands swept to and fro; for the bar is but a broken portion of the *cordon littoral* of which Sandy Hook and Coney Island are dry parts. Its channels are maintained by a slight preponderance of the seaward flow, as our observations distinctly show.

Another and nearly related advantage of this circulation is, that the heavier sea-water runs low, and sweeps the bed of the harbor; whereas, were the harbor tideless, the river outflows would be superficial on reaching the basins, and these basins would in course of time fill up. This superficial flow of fresh waters on reaching the sea is a well-known phenomenon. The clear sea-water, with the full density of the ocean, may be pumped up from a few feet below the entirely fresh water of the surface at the mouths of many rivers, notably those of great discharge.

The fresh waters that enter from the Hudson and other streams play an insignificant part in the physics of the harbor; but the circulation of the sea by way of the East River, although small in quantity, is the element which determines the superiority of New York harbor over nearly all the 'sand-barred inlets' of the world. It is this circulation which keeps the port open in winter and sweeps the sand from its threshold.

HENRY MITCHELL.

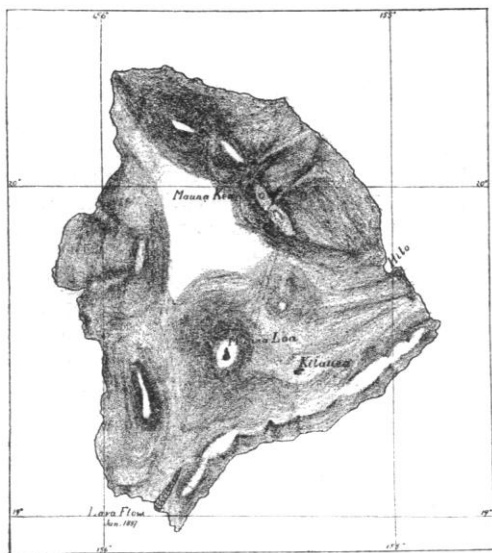
THE RECENT ERUPTION OF MAUNA LOA.

MAUNA LOA is again in eruption after an interval of six years since the lava-stream of 1881, which so closely grazed the town of Hilo. The present flow is on the south-west side of the mountain, entering the sea immediately north of the flow of 1868, or, rather, two miles from it. The source is about twelve miles farther up the mountain than in 1868, or twenty miles from the sea. An aneroid observation gave 5,700 feet elevation for the lower end of the fissure. The points of emission ranged for three miles along the vertical fissure, which appeared to extend some two miles higher.

On the evening of Jan. 16 a sharp jet of lava was observed shooting up from the Mokuaweoweo 'caldera' at the summit of Mauna Loa to an immense height, lasting ten minutes, with gradual subsidence. This is the common precursor of a flow from a lower point. The actual flow

began on the 18th, more than halfway down the south-west flank, as above stated. It was extremely copious, rising in several large fountains from one hundred to two hundred feet high, and reached the sea in twenty-six hours. The width of the somewhat crooked and irregular stream probably averages three-fourths of a mile, which is about its width on the seashore.

I was unable to reach the scene until Feb. 2, when it had just ceased to flow, and there remained only the hideous scoria embankment—'monstrum horrendum, informe, ingens, cui lumen ademptum.' Until the previous night the fountain had continued to be a powerfully brilliant object, and the streaming lava conspicuous on the



slopes. Spots of glowing cinder were still to be seen on the front of the embankment, as our steamer laid by for daylight. Our tourist crowd of two hundred people landed in the morning. No difficulty was experienced in traversing the many square miles of piled scoria in any direction, except the incredible raggedness of the surface. Occasional pits or rents disclosed the fiery interior. The lava seemed to be of unusually high specific gravity, judging by samples of wave-assorted fragments on the many beaches in the coves of the sea-front. The embankment seemed to average about thirty feet in depth above the old lava of the foot-plain of two miles, tumbling over a low precipice of twenty feet, having filled out from three hundred to five hundred feet into water of thirty fathoms, along four thousand feet of shore, making about thirty acres of new land. No cinder-cones had been formed by the contact with the sea on this occasion, although six or

seven such stood in the immediate vicinity, one having risen out of the sea at the flow of 1868, and immediately been united by lava to the land.

This new flow is almost exclusively *aa*, or clinker. The neighboring flow of 1868, equally sudden and copious, was *pahoehoe*, or smooth, hummocky lava. The new flow appears to abound in olivine. Unlike the eruption of 1868, which was preceded by long-continued and destructive earthquakes, there was little premonition this time, and no very serious damage was done to the large sugar-mills a few miles distant, except the rupture of one reservoir in the vicinity of the mud-avalanche of 1868. In actual quantity of lava emitted, the present is largely in excess of the other. Experienced observers in Hilo are confident that this is only a temporary intermission of flow, and that activity will speedily be resumed, with probably a *pahoehoe* flow, such having been the general history of previous large eruptions, like those of 1881 and 1855.

I desire to note particularly the presence of a heavy stationary line of dark cloud, lying precisely over the line of the whole flow from the sea to high up in the mountain. This cloud remained without change of form or position during the twenty hours of our presence in the vicinity, and served to mark the position of all parts of the flow with great precision. Although a little puffing of steam was rising along the sea, nothing but dry heat ascended from any point inland, save two very small columns of sulphurous smoke four miles up. In walking over the flow, currents of highly heated air had to be avoided, but no steam was observed, nor smoke, nor troublesome fumes of any sort. Yet a dense and massive condensation of vapor was constantly going on directly overhead. I judged the source of this vapor to be solely and entirely from the inflowing currents of air with their ordinary charge of water-vapor. These were drawn in and driven up from the immense heated surface, and, on reaching the necessary height, precipitated their contents into the dark cloud-bank, just as naturally as the sea-breeze piles its clouds daily against the mountain-flank all along that coast. It needs to be understood that the evolution of heavy cloud above lava is no positive proof that steam is rising from that lava. The inflowing air-currents may supply all the vapor seen.

A similar but smaller cloud-bank was seen resting over Kilauea's fire-lakes as we steamed past late that afternoon. On the early morning of the eruption of 1868, I observed its glow from the distance of 143 miles at Lahaina, and obtained a good altitude of the enormous cumulus-cloud of vapor rising from its heat. With due correc-

tions, this gave an estimated height of seven miles. Probably steam from the boiling sea was contributing to this cumulus. About six square miles of glowing surface were then radiating heat, all near the sea, the point of emission being only seven miles back, and 3,500 feet up. I judged, however, that the chief source of the vapor was the one above named, — inflowing atmospheric currents. That cumulus was naturally blazing with incessant lightning, visible even after sunrise at that immense distance. Some brownish smoke could be distinguished around

THE RIVIERA EARTHQUAKE.

THE accompanying sketch-map shows the scene of the late destructive earthquake. The centre of the disturbance was in the Italian province of Porto Maurizio and the adjoining French Departement des Alpes Maritimes. Two severe shocks in quick succession occurred on Feb. 23 at 6 A.M. They did a great deal of damage all along the coast, and were felt far inland. The heaviest loss of life and property was sustained in the district of Oneglia, 570 persons being killed and 156 injured. The villages of Diano-Marina, Diano-Cas-



the lowest part of the snow-white pile of cumulus. Previous to the actual outflow of 1868 an enormous emission of smoke had taken place, which densely shrouded Lahaina and the whole group for many days, objects one mile distant being invisible to us when at the thickest, and a very distinct odor of sulphur being present.

The present eruption was first announced to us at Honolulu by the pervading smoke, continuing from the 20th to the 30th of January. The smoke is evidently first discharged into the upper current, and transported far to the east-north-east before settling down into the trade wind, which brings it back upon us.

S. E. BISHOP.

tello, and Bajardo were almost destroyed. In the province of Genoa thirty-four persons were killed and thirty-seven injured, and in the Departement des Alpes Maritimes eleven persons were killed. The following reports show the extent of the disturbance: at Toulon two violent shocks were felt at 6 A.M., the first shock of fifteen seconds duration, the second of twelve seconds. The movements were from west to east. At Cannes three shocks were felt at the same hour. At Cuneo and Turin they did considerable damage. Earthquake shocks were observed in south-eastern France, Switzerland, Piedmont, Lucca, and Corsica. On Mount Vesuvius the instruments did not indicate any dis-

turbance, while those of Etna and at Catania were much agitated. The steamer *Guadeloupe* felt two shocks in latitude $43^{\circ} 45' N.$ and longitude $5^{\circ} 39' E.$ at 6 A.M., and a third one at 8 A.M. At Cannes and Antibes the sea fell three feet at the moment of the chief shock, and then rose six feet. The seismoscope at Washington was disturbed at 7.33 A.M. On Feb. 24, slight shocks occurred at Mentone and at Digne (Departement des Basses Alpes), and on the following day at 1.53 A.M. a shock was reported from Nice, and at 2 and 4 A.M. from Cannes.

This earthquake occurred on the large fault on the south-western side of the Apennines. A glance at the map shows the difference between the declivities of the Apennines. North of Genoa the Molasse hills gradually rise from the plains of Piedmont, forming a continuous curve, which may be observed from here to the Bay of Taranto. Inside of this continuous belt we find limestone, forming the Abruzzo, Gran Sasso, and the Basilicata. This line is interrupted in Tuscany. Still farther inside, on the west coast, and partly submerged in the Tyrrhenian sea, we find the separated *débris* of the ancient crystalline rocks. Here is the great fault between the sunken tract now occupied by the Ligurian and Tyrrhenian seas and the mountains. It is marked by the long lines of volcanoes and countries of frequent seismic disturbances. The east side of the Apennines is regularly folded: the west side is torn, and a seat of volcanic and seismic action. The folded side is convex and continuous: the opposite one is broken by faults and sunken tracts. Inside of the Apennines there are a great number of sunken tracts arranged on a long line, the curved limits of which cut far into the range of mountains: the Gulf of Genoa, Salerno, Naples, and the bay around the Lipari Islands are the centres of regions of this kind. The movements of the strata along these faults give rise to the numerous violent earthquakes of western Italy.

LONDON LETTER.

THE unsavory subject of the disposal of London sewage continues to attract much attention, and to create considerable interest. On three successive evenings the large theatre of the Institute of civil engineers has been crowded to excess to hear the discussion on papers by Messrs. Dibdin and Crimp on sewage-sludge and its disposal. The most telling speech was that of Dr. Meymolt Tidy, who, in a most incisive manner, delivered a heavy indictment against the Metropolitan board of works, on the ground, that, when forced by public opinion to do something to remedy the nuisance

in the Thames, they summoned to their aid the very chemists who had previously given evidence before a royal commission to the effect that there was no sewage nuisance in the river! He ridiculed unsparingly the treatment by lime and ferrous oxide, and by sodium manganate, which had been adopted by the board, and also Mr. Dibdin's view that the ferrous oxide acted as a carrier of oxygen between the air and the sewage in which it was suspended. The idea that sewage could be 'made to pay' had done more than any thing else to restrict advances in the mode of dealing with it: such processes were like those for extracting silver out of sea-water. On another occasion the advocates of irrigation and sewage farms had their say at the Society of arts, where Dr. Alfred Carpenter gave his experiences of the Croydon sewage-farm, near London, which were very favorable. Such an opinion has especial value, as the author is well known as a distinguished sanitarian and medical officer of health. The local conditions for successful sewage-irrigation are not easily obtainable. There are, however, many places near American cities, within the knowledge of the present writer, where sewage-irrigation might be applied with the greatest advantage.

Another subject much before the scientific public at present is the employment of gas for lighting and heating. Mr. Colnaghi has lighted a small picture-gallery most efficiently by the gaslight system of Dr. von Welsbach of Vienna. The figures given are an average consumption in each burner of two feet per hour, at a pressure of nine-tenths of an inch, and an average illuminating-power of seventeen candles, or eight and a half candles per cubic foot of gas consumed. Within an ordinary atmospheric or Bunsen flame, is placed a mantle or hood of cotton net or webbing which has been previously steeped in a solution of oxides of zirconium and lanthanum. Mr. William Sugg, the well-known gas-engineer, lately gave a most successful gas-cooking demonstration, in which the non-luminous flame is abandoned in favor of the radiant heat from a luminous flame in a well-ventilated chamber. The gas supply is regulated by a governor, and the results can be predicted to a nicety. The loss in roasting a joint is reduced from twenty-five per cent to eight or twelve. Neither the food nor the vessels containing it are touched by the flame: hence unpleasant flavors are avoided, and the whole apparatus, which is adaptable to many different culinary operations, has the merit of great simplicity. A very striking lecture, well illustrated, was recently given to the Manchester technical school, on 'Some curious flames,' by another gas-engineer, Mr. Thomas Fletcher. He strongly insisted, that, in the ab-

sence of a solid substance at a high temperature, it is impossible to cause combustion without flame, and that when a flame is used, it is impossible to make it touch a cold surface. The existence of this impassable cold zone was demonstrated by many curious experiments, and its practical consequences were pointed out. There was much of a deceptive character about the mere appearance of flame.

The New Zealand earthquake of June 10, 1886, and the destruction of the famous terraces, have lately come in for a large share of public attention; the Society of arts, the Geologists' association at their annual meeting, and the Geological society, having each recently devoted an evening to it. The readers of papers were respectively, Mr. Kerry Nichols, Mr. W. Lant Carpenter, Captain Hulton, and Mr. J. Martin. In the first two cases some marvellous photographs, taken by the search parties sent up during the eruption, were thrown on the screen. The hydrothermal character of the whole was well brought out, one striking view being that of a rent in the top of Mount Ruawhia, five hundred feet deep, six hundred yards across, and a mile and a half long, which was blown out in *three minutes*.

An unusual number of changes are in progress among the staff of the Natural history museum at South Kensington. During the past year the zoological department has lost the services of Mr. E. J. Miers and of Mr. J. J. Quelch, who had charge of the Crustacea and Zoöphytes respectively. The former gentleman, however, continues to do unofficial work in the museum; but Mr. Quelch has gone to Demerara as curator of the museum there. Mr. S. O. Ridley, who has done so much good spongiological work, is about to leave the museum and take orders. The geological department is also on the point of losing its two senior assistants. Mr. R. Etheridge, jun., will shortly return to the scene of his earlier scientific work in Australia, where he has received the appointment of paleontologist to the Australian museum and the department of mines at Sydney. The geological department will suffer considerably by the loss of his accurate and comprehensive knowledge of invertebrate paleontology, and his wide experience in the arrangement of fossils for exhibition. It is not too much to say that in this latter respect the British museum is far in advance of any other museum in Europe, as is universally admitted by our continental visitors; and for this result the museum authorities are very largely indebted to the care and skill of Mr. Etheridge. Almost the same may be said of Mr. W. Davies, who is about to retire on a well-earned pension, after a prolonged period of service, dur-

ing which he has had charge of the fossil vertebrates. Although he has published little, he has done very much for vertebrate paleontology, both in the preparation of specimens for investigation and exhibition, and from the unselfish way in which his extensive knowledge has always been unreservedly communicated to other workers. Many important observations which are recorded in paleontological memoirs by various authors are in reality due to the work of Mr. Davies, though this fact has not always been made known by the writers of the memoirs in question.

The *Zoölogical record*, the future existence of which has been in danger of late, is now to have a new lease of life. For some time past the subscription-list has not sufficed to pay the working expenses, and negotiations were set on foot with Dr. Anton Dohrn, in order, if possible, to bring about a union of the *Record* with the later established *Zoologischer Jahresbericht*. These have fallen through, however, and so the Zoölogical society is about to undertake the publication of the *Record*. It will remain under the able editorship of Prof. F. J. Bell, who has brought out the last few volumes. These have appeared within the year succeeding that of which the literature is recorded; and in this respect the English work has the advantage of its German companion, which is, however, much more comprehensive in its scope.

Fermentation in relation to bread-making has been investigated by Mr. W. Jago, who communicated his results to a recent meeting of the London section of the Society of chemical industry. Discarding entirely the prevalent idea that the main object of the fermentation was the aeration of the bread, he described an apparatus, and the results obtained by its use, for comparing the amount of fermentation produced under the same conditions in various elements of the flour separately (e.g., gluten, starch, aqueous extract, etc.), by measuring the amount of carbon dioxide evolved from the same weights in the same periods. The ferment employed in all cases had been the pressed distillers' yeast, usually obtained from rye. It was elicited in the discussion which followed, that both the author and others were engaged in investigating the separate actions of the different kinds of ferments to be found in bakers' yeast, and, in fact, in endeavoring to put the chemistry of panification on the same sound basis as that recently established for the fermentation of beer. These results will be looked for with much interest.

At the same meeting the first scientific data were given about the recent English-grown tobacco. The percentage of ash was very much

higher than in either American or German tobacco, indicating that the plant had been much 'forced;' and it contained much more lime than usual in proportion to the potash and soda, as well as a high percentage of chlorine. Moreover, water extracted one-third more of soluble matter from English than from American tobacco.

It may be worth noting that this society has now nearly three thousand members, that its journal is entering on its sixth volume (published monthly under the direction of a committee), and that its aims are perfectly distinct from the Chemical society, which deals with pure science, and from the Institute of chemistry, which is mainly an association, for professional and self-protective purposes, of analytical chemists.

A paper on 'Telephonic investigations,' by Prof. S. P. Thompson, is giving rise to three nights discussion at the Society of telegraph engineers and electricians, of which the veteran Sir Charles Bright is now president. The paper, which is well worthy of attentive study, contained an almost exhaustive classification of telephonic transmitters, receivers, and transformers, — an account of the author's numerous researches thereupon, and especially of his 'valve' telephone, — and an elaborate discussion of the effect of heat in microphonic contacts. The author concluded with the following sentences, upon which the discussion mainly turned: "In conclusion, I would reiterate my conviction that the success of long-range telephony depends upon the possibility of devising instruments which, on the one hand, can be used with higher battery power to transmit stronger currents, and which, on the other hand, will be adapted to receive these currents by means of apparatus which, though not necessarily more sensitive to small currents than the present receivers, will have a higher electrical and mechanical efficiency. And I am convinced that the path of progress lies very near the road already travelled by those who have perfected the existing machinery for the electric transmission of power."

The direct opposite of this was very stoutly maintained by Mr. Preece, head electrician of the post-office telegraphs, who argued that both on theoretical grounds, — viz., that, in Sir W. Thomson's law, the value of a in the equation

$$a = CKr^2$$

was independent both of current and of electro-motive force, — and also as the result of practical experiments, a great number of which were quoted, long-distance telephony was a question, not of instruments, but of line.

At the annual meeting of the Physical society of London, held this afternoon, Prof. Balfour Stewart was re-elected president, and Dr. E. At-

kinson, who for many years has been treasurer, was elected a vice-president, while Prof. A. W. Rücker (the recently appointed successor to the late Professor Guthrie at the Science schools, South Kensington) was appointed treasurer. The society adopted an alteration of its rules, whereby membership of a foreign or colonial scientific society shall in future be held equivalent to the personal knowledge, on the part of members of the society, of candidates for its membership. W.

London, Feb. 12.

GEOGRAPHICAL NOTES.

Africa.

The latest letter of Dr. O. Lenz is dated December, 1886. On June 30 he left Kasonge, which was being ravaged by small-pox. After he had left the village the disease broke out among his caravan, and among those who died of it were his own and Bohndorf's servants. On the 7th of August he reached the Tanganyika, where he met with the English missionaries. He crossed the lake to Ujiji, whence he wished to go north. However, on account of the war between the Arabs and northern tribes, he was unable to continue his journey, and was obliged to proceed towards the east coast. He did not follow the well-known route from Ujiji to Bagomoyo, but chose the Zambezi route. He crossed the land between the Tanganyika and Nyassa, went by boat over Lake Nyassa and down the Shire and Zambezi. Having reached Kwilimane at the mouth of this river, he embarked for Zanzibar. His arrival there was announced a short time ago.

Le mouvement géographique of Feb. 15 contains an interesting sketch-map of the district north of the Kongo by A. J. Wauters, showing the present state of our knowledge of the hydrography of that country according to the explorations of Junker, Grenfell, Lupton Bey, and Flegel. The Welle-Makua has been copied from a sketch furnished by Dr. Schweinfurth, and shows the important discoveries of Dr. Junker.

Stanley has left Zanzibar for the Kongo. At the same time the famous Arabian trader Tippu-Tip started for Stanley Falls, and has promised to support Stanley's expedition.

The January number of the *Bulletin* of the Paris geographical society contains an accurate map of the Ogowe in West Africa by Lieutenant Mizon, and of his return journey to the coast. In the paper which accompanies the maps, Mizon describes the methods of observation, and gives the positions of some of the more important points. The maps are on the scale of about one kilometre to an inch, and contain a great deal of topographical and orographical detail.

America.

The Hudson Bay company last autumn completed a steamer for the lower part of the Mackenzie River. Trial trips were made on Great Slave Lake, and next summer she will run to Peel River, near the mouth of the Mackenzie.

The Geographical society of the Pacific at San Francisco announces the recognition of the new monthly journal *Kosmos*, edited by C. Mitchell Grant, as its official organ. The new periodical will give reports on the meetings of the society. Though its plan includes all branches of science, the first number is largely devoted to geography. We find in it a description of the ascent of Mount St. Elias by H. W. Seton-Karr, and a paper by Prof. George Davidson on 'Submarine valleys on the Pacific coast of the United States.' The resuming of publications by the geographical societies of San Francisco and Mexico shows that interest in geography is increasing in America.

Polar regions.

Mr. Alexander McArthur, formerly an employee of the Hudson Bay company, left Winnipeg, Feb. 13, on an exploring expedition to the polar regions. He intends to go from Winnipeg to Fort Churchill, and to continue his journey along the west coast of Hudson Bay. While Gilder proposes to push north by the way of Fury and Hecla Strait, McArthur prefers to go north-west by the way of King William Land and Boothia Felix, the ill-famed districts of Ross's sufferings in 1829-33, and of the loss of the Franklin expedition. He intends to stay a winter on King William Land, and to go north in the ensuing winter, crossing Lancaster Sound, and following the west coast of North Devon. From there he proposes to cross to the little-known islands of Jones Sound and thus reach the west shore of Grinnell Land, which, he hopes, will prove a safe route north. He expects to be absent some three or four years. This plan of reaching the north pole will undoubtedly be as unsuccessful as Gilder's. Gilder has ample experience in arctic travelling, and consequently does not attempt a route that is even unknown to the Eskimos. The way he intends to go is inhabited by natives, and, under favorable circumstances, he may have a chance to reach Lancaster Sound in the spring of 1889. Whether he will be able to cross Lancaster Sound is doubtful. The Eskimos travel very rarely across this strait, and the journey can be accomplished only in favorable years when it is frozen over, which does not occur often. As steam-whalers go every year to Smith Sound and Pond's Bay, Gilder's plan cannot be considered a good one, though he might do considerable geographical and ethnological

work between Fury and Hecla Strait and Pond's Bay. He will have the greatest difficulty in getting Eskimos to go along with him across Lancaster Sound. Food is very scarce on this journey, and many stories of the natives referring to families crossing Lancaster Sound are full of the horrors of starvation and cannibalism. The natives of Cape Isabella are said to be comparatively well off, and these are the only ones who can help an explorer along. We cannot see any reason why a traveller who intends to explore the extreme north should not start from the nearest available point instead of wasting his time and strength on a hazardous journey for which there is no necessity. Mr. McArthur may succeed in reaching King William Land, as there exist two or three routes to that country which are used by the natives, — one from Chesterfield Inlet, another from Wager River, and a third along the coast of the Gulf of Boothia. Rae and Hall used the last, and Schwatka the second route. As, however, the Eskimos of King William Land and Boothia do not travel farther north than Bellot Strait, and since 1833 do not even visit this part of the coast, and as they are not at all acquainted with the more northern parts of the Arctic Archipelago, there is not the slightest chance for McArthur to get along on this route. Explorers like McArthur and Gilder may accomplish considerable and valuable work when they confine themselves to a task adequate to their means and the strength of a single man, but the accomplishment of their plans is almost impossible. The exploration of Jones Sound is one of the most important problems of the geography of arctic America, and it may be accomplished by a few men at a small expense. Gilder is a man of extensive experience in travelling in the Arctic, and we may be allowed to express the wish that he should give up his present plan and apply his energies and skill to this important work which he will be able to accomplish.

NOTES AND NEWS.

NOT long ago Nicolaier, working in Flügge's laboratory, found a bacillus which had the power to produce in animals the phenomena of lock-jaw (*tetanus traumaticus*). Afterward Rosenbach succeeded in obtaining the same bacillus from the wound of a man who had died of lock-jaw. L. Brieger has recently prepared from flesh a ptomaine which produces in animals the same symptoms as those which are produced by injecting the specific tetanus bacillus. To the substance he gives the name 'tetanine.' He has, further, found the same substance in human cadaver which had

for several months been undergoing spontaneous decomposition. Tetanine is a definite chemical compound which can be purified by the usual chemical methods, and was so purified by the discoverer. Brieger also found in tetanus-cultures another ptomaine which has the power to produce cramps and other symptoms closely resembling those of lock-jaw. The finding of the tetanus-bacillus and of tetanine suggests an explanation of certain facts which have been known for some time. In some localities persons with wounds are particularly liable to lock-jaw. In one such locality, at least, large areas of land are covered for a part of the year with the refuse from fish-oil factories. It seems not improbable that in the decomposition of the fish the ptomaine described by Brieger may be formed, and that as the matter dries it may find its way into the air to some extent; or it may be present in the earth, and contact with the earth may cause its introduction into a wound.

—One of the most valuable contributions to science now in course of preparation is a series of charts showing the surface temperatures of the Atlantic coast waters from the eastern coast of Maine to the extreme southerly coast of Florida. This important work is being prosecuted by the U. S. fish commission, with the aid of the lighthouse board and the signal service, and is based upon observations made thus far at twenty-four lighthouse stations, showing the surface temperatures at these localities during the past five years. The temperatures at each station are shown in detail for each year by ten-day means, and these results are combined with a series of isothermal charts showing the relations of the different stations. These observations have a most important bearing on the study of the migration of the mackerel, menhaden, shad, and other migratory fishes, and will be of great value. Other temperature observations of the inland waters of the United States are now in course of reduction, and will shortly be issued.

—The prevalent belief that an Indian bears pain with perfect composure is likely to be overthrown by the observations of Dr. Corbusier among the Apache Indians. He finds that they do not endure physical pain any better than, if as well as, the whites. Great pain renders them stupid, and the stolidity with which they are supposed to bear pain is not well maintained by them under small surgical operations, even the extraction of a tooth almost always eliciting a groan or a yell. The pain which is usually on their faces conceals their expression. When this is removed, the changes induced by the emotions may be readily

detected: anger is almost always betrayed by the expression of the eyes, fear by the dirty grayish color the skin assumes, surprise by suddenly drawing in a breath as if gasping, and sometimes by covering the mouth with one hand.

—The Linnaean society of New York have passed resolutions asking congress to make adequate laws for the preservation of the native animals, forests, and the many objects of wonder and scientific interest contained in the Yellowstone national park. The resolutions were presented in both houses of congress on Monday last.

—The desire has been frequently expressed for an American journal devoted to the interests of agricultural science, and several unsuccessful efforts have been made to establish one, but the modest journal under the title of *Agricultural science* (Charles S. Plumb, Geneva, N.Y.), whose first two numbers lie before us, is, we believe, the first of them which has proved viable. The purposes of the new journal, as stated by the editor, may be summarized as, first, the publication of original work in agricultural science; second, the publication of abstracts of articles in foreign journals; third, to furnish a means of communication for students and investigators in this line. In the numbers before us the two latter aims of the journal are more amply fulfilled than the first. The abstracts are well selected and prepared, and not a little news of interest is presented. The original articles are five in number, and take up twenty-one out of forty-eight pages, but only three of them contain the record of any original work, and the main points of one of these have been previously published, so that we have in the two numbers eight pages of fresh, original investigation. This fact seems to us to show plainly one of the chief difficulties likely to beset the editor, viz., a paucity of original investigations. The amount of original scientific work performed at the various agricultural colleges and experiment stations is not large, and considerable of what is done seems likely to find its final and only means of publication in annual reports and the like. At the same time, we wish the new journal all possible success. The attempt is certainly a most laudable one, and the execution thus far praiseworthy. Whether the two obstacles of paucity of material and a necessarily somewhat limited number of readers can be overcome, time must show.

—The publication agency of the Johns Hopkins university has now ready for issue vol. i. of a series of selected morphological monographs by members of the university, under the editorial direction of W. K. Brooks, Ph.D. The volume contains three hundred and seventy pages and

fifty-one plates, quarto. The contents are, 'Lucifer: a study in morphology,' with eleven plates, by W. K. Brooks; 'The development of Renilla,' with sixteen plates, by E. B. Wilson; 'The life-history of the Hydro-Medusae: a discussion of the origin of the Medusae, and of the significance of metagenesis,' with eight plates, by W. K. Brooks; 'Report on the Stomatopoda,' with sixteen plates, by W. K. Brooks. Only one hundred copies in all will be issued. The price is fixed at seven dollars and fifty cents net, delivered by mail, postage paid, or by express at the expense of the purchaser.

—The Smithsonian institution has received notice from Col. J. H. Wood of St. Paul that he has shipped to them the bodies of five persons—a man, woman, and three children—taken from a cave in the Bad Lands of Dakota by a miner. The bodies are simply dried up, and are not petrified, but are in a remarkable state of preservation. Scientific men who have seen them say they belong to a race which existed two thousand years ago. This will be a very important addition to the collection of desiccated bodies now on exhibition in the national museum.

—Dr. Baker, secretary of the Michigan state board of health, has found that in that state small-pox has been comparatively epidemic every five years. In 1872 there were 302 deaths from that disease, in 1877 there were 102, and in 1882 there were 100. He looks for its appearance in the state again this year.

—The statement is made that supernumerary toes and fingers are very often met with among the negro tribes living beyond the Orange Free State. Dr. Stockly mentions the case of a Caffre, eighteen years old, who had six fingers on each hand. His father, mother, four sisters, and a brother had the same. His mother had also a double series of toes on both feet.

—The January meeting of the Michigan state board of health was especially noteworthy by reason of a report of a special committee which had been appointed to confer with the regents of the university relative to the establishment of a laboratory of biology and hygiene at that institution. As a result of the agitation of the subject, the legislature of the state has been memorialized to establish such a laboratory.

—An unnamed fever is said to be very prevalent in Jerusalem, the patients being so numerous as to fill a large hospital camp. As quinine is said to be greatly in demand, we presume the fever is of malarial origin. It is thought that the spread of the disease is due largely to polluted drinking-water and unwholesome food.

—Reference was made in a recent number of *Science* to the deaths which occurred in January of the present year in the city of Troy, N. Y., from the inhalation of fuel-gas. The *Medical news* contains a history of these cases from the pen of Dr. Bontecau, who assisted at the autopsies held on the victims, and attended others who recovered. The occupants of a row of dwellings were almost all seriously overcome by the gas. When the cause was discovered, the police aroused those who lived in these houses, many of whom were found sick. All the occupants of one flat were dead. At the autopsies the solid tissues and the blood were found to be of a cherry-red color, which is characteristic of poisoning by carbonic oxide. The composition of the fuel-gas which was used in these houses is said to be, hydrogen 56, and carbonic oxide 44, parts in 100.

LETTERS TO THE EDITOR.

*.*Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

On certain electrical phenomena.

IN *Science* of Feb. 18, Dr. Shufeldt relates some interesting instances of accidental electrification. He seems to imply, in his description of the phenomena, that there is something mysterious or unusual in such occurrences. If he will critically examine his facts, possibly eliminating a few of them, I think he will find nothing which is not easily accounted for, and which has not been long recognized. I have amused myself and many of my friends with this sort of thing for many years. The electrification of a man or a woman in moving about a room is a phenomenon in which the individual is not to be counted, as it depends entirely on the conditions existing at the time. Everybody is 'susceptible' if the conditions are favorable. As Dr. Shufeldt states that he had never observed such exhibitions in Washington, I may remark that in two different houses in which I lived in that city I observed them on innumerable occasions. In one of these I arranged a couple of bent wires in such a way that the spark passed between them directly over the opening of a gas-burner, and for several weeks matches were a useless luxury. In another house that I know of, dancing-parties were especially gotten up by the young people, that they might be amused by the passage of the spark in touching hands. In the latter instance the phenomenon was strongly marked during nearly all of a continuously cold winter. During the present winter, in the house which I now occupy, accidental electrification has several times reached such a point as to be positively disagreeable. In moving across a room to turn a water-faucet, or to touch a poker or any other fairly good 'ground,' a long spark and an uncomfortably strong shock would result. But this was confined to no person or persons; any one who happened in was affected in the same way, provided the conditions were equally favorable.

The necessary conditions are simply those which are required for the successful performance of any

experiment in 'frictional electricity'—so called. Given a house heated by a hot-air furnace or by steam, a floor covered with soft carpet which, in virtue of the furnace heat, is dry and warm, a man the soles of whose shoes are thoroughly dry, and electrification will probably result from every brisk movement of the man over the carpet. These conditions are most likely to be met with during cold winter weather, and it is then that the phenomena are generally noticed. It is not probable that Dr. Shufeldt's two friends can perform the feat of lighting gas in this way 'at all times and under all circumstances.' His statement that the "electrical discharge was considerably greater from the tip of the index finger than from any of the others of the hand, and gradually diminished in regular order as we proceeded to the little finger," is interesting, but needs confirmation. I am sceptical as to the charging of his entire system 'with this animal electricity,' and the results which followed such a condition, and particularly so as to the origin of the "sense of the most profound relief, as if it were that all the electricity of my system had been completely withdrawn by the act," which he experienced when his hand touched the back of the young mulatto girl. Is man one of the extremely small number of animals having specialized electrical organs? T. C. M.

Terre Haute, Ind., Feb. 22.

Inertia-force.

The importance of clear elementary ideas on the teaching of dynamics justifies me, I think, in asking space for a further discussion of Dr. E. H. Hall's 'inertia-force.'

In his letter published in *Science* of Feb. 18, Dr. Hall expresses the opinion that our difference with regard to 'inertia-force' is based upon a difference of interpretation of the term 'force.' That, I think, is not the case. With all his statements as to force in general I agree; and the passage which he quotes from Maxwell, as expressing his view of force with sufficient accuracy, expresses also my view with complete accuracy. Dr. Hall, indeed, says that this passage meets many of the points raised by me; and it would thus seem that it must be inconsistent with many of my positions. But I am unable to detect the inconsistency, and Dr. Hall merely asserts it without giving any proof.

I am in full agreement also with Dr. Hall, not in opposition to him as he supposes, when, passing from force in general to a particular case, he says that a ball swinging in a circle at the end of a string acts upon the string with a force directed from the centre. The ball certainly does exert such a force. I think it misleading to call that force centrifugal force, as he and many writers do; but that the force which he calls centrifugal force is an actual force is undoubted.

But when Dr. Hall proceeds to expound his 'inertia-force,' we seem to part company, perhaps because he has not given a complete specification of this force. He has told us its magnitude and its direction, but its place of application, the body on which it acts, he has left us to infer from the context, and my inference he calls in question. It would be useless for me to justify my inference, because in Dr. Hall's letter he modifies the statement of the pamphlet from which it was drawn, saying that what he meant was that "the inertia-force works [or acts] with the

smaller applied force *against the agent which exerts the greater force.*" From this modified statement I could not, of course, have made the inference referred to,—in fact, I could have made no inference at all; for it is couched in language which is not the current language of dynamics, which is not defined, and which I must confess I do not understand.

Let us, however, take Dr. Hall's new illustration, and see what light that throws on the place of application of inertia-force. "A train is being started by a locomotive. The forces *applied* to the train are the pull of the locomotive, and the smaller, opposing, force of friction. The pull of the locomotive prevails, but in prevailing it must deal not only with the resistance due to friction, but with the reaction (which also I call resistance) due to the inertia of the train," in other words, the inertia-force. Here, again, Dr. Hall uses terms not current in dynamics, and I do not understand what he means by the locomotive 'dealing with' both the frictional resistance and the inertia-force. Whatever may be the exact meaning of that phrase, however, it seems clear that if the inertia-force acts on the train, and if the pull of the locomotive has to deal with this force in moving the train, it must be expected to have some effect on the motion of the train. Yet if F is the pull of the locomotive, R the frictional resistance, M the mass of the train, and a its acceleration, we have undoubtedly, by Newton's second law of motion,

$$a = (F - R) \div M;$$

and hence the inertia-force is quite without effect on the motion of the train. It would seem, therefore, that the inertia-force cannot act on the train. Does it then act on the locomotive? If so, it can only be the force which the train exerts on the locomotive, which is of course equal and opposite to the above force F . But it cannot be this force; for if the brakes be put on the train, though the pull of the locomotive on the train—and therefore the force exerted by the train on the locomotive—may be kept constant, the acceleration of the train will change; and, according to Dr. Hall, the inertia-force must be proportional to this acceleration. Thus even this new illustration does not enable us to determine on what body the inertia-force acts.

This difficulty in determining the place of application of the inertia-force would be at once accounted for if it should be found to have no place of application at all, and I strongly suspect this to be the true conclusion. Dr. Hall seems to me, in fact, to have postulated a hypothetical force to account for the supposed resistance of a body to the action of an applied force, and to have thus fallen into the error referred to by Poisson in the following sentences:—

"Concevons qu'un corps soit posé sur un plan horizontal, et qu'il n'y soit retenu par aucun grottement. Si je veux le faire glisser sur ce plan, il faudra néanmoins, à cause de l'inertie de la matière, que j'exerce un effort quelconque. . . . J'aurai, dans chaque cas, le sentiment de l'effort que je serai obligé de faire; mais je ne devrai pas en conclure que la matière oppose aucune résistance à cet effort, et qu'il existe dans les corps ce qu'on appelle très improprement une *force d'inertie*. Quand on s'exprime ainsi, on confond la sensation que l'on a éprouvée, et qui résulte de l'effort qu'on a exercé, avec la sensation d'une résistance qui n'existe réellement pas" (*Traité de mécanique*, tome i. § 120). J. G. MACGREGOR.

Halifax, N.S., Feb. 22.

SCIENCE.—SUPPLEMENT.

FRIDAY, MARCH 4, 1887.

THE MAGNETIC AND TIDAL WORK OF THE GREELY ARCTIC EXPEDITION.

It is well known that the expedition sent out by the government to Lady Franklin Bay in command of Lieut. A. W. Greely, U.S.A., was one of two expeditions to co-operate with and form part of the physical explorations proposed by the International polar commission. By invitation of its president the late General Hazen, chief signal officer, accepted the organization and fitting-out of two parties, one, under Lieutenant Greely, to proceed to the shores of Lady Franklin Bay, Grinnell Land, the other, under Lieut. P. H. Ray, to go to Ugliaamie, Point Barrow, Alaska. While the general responsibility, the supervision, the accounts, the selection of men, and their transportation to and from the stations, remained in his own hands, General Hazen requested and received the aid of the coast and geodetic survey in the special departments of terrestrial magnetism, of tides, and gravitation. The assistance of the survey by its then superintendent, Capt. C. P. Patterson, consisted in furnishing such instruments as could be spared from its limited supply, in training the observers for their work, and in providing them with the necessary instructions and forms of record for the proper performance of their duty. It so happened that congress had already (in 1880) authorized a scientific expedition to Lady Franklin Bay, but the funds were appropriated so late in the spring of 1881 that it was found impossible to procure the needed special instruments and to give that thorough training to the corps of observers which could only be attained by ample time for preparation. Indeed, the commission itself found it expedient to start other expeditions a year later, in order to obtain better organization of the scientific labor, and especially for the construction of suitable magnetic differential instruments.

There is no need of referring here to the general history of the two American expeditions, as we already possess the official publication of the one under Lieutenant Ray, and the narrative of the Lady Franklin Bay party, in two handsome volumes, by its leader, Lieutenant Greely. By his permission we are enabled to lay before the readers of *Science* the general results of his labors during 1881-84 in the domains of terrestrial magnetism and of tides. They are extracted from the

manuscript now ready for the printer, but it is not our intention to enter minutely into any details, which would be here out of place, nor to forestall the judgment of scientists on the merits of the work: this must be reserved for a time after the official publication and when the results by the several international expeditions can be compared and collated. A brief statement of facts so far as they relate to that part of the work which was intrusted to the special direction of the U.S. coast and geodetic survey, is all we propose to give at present.

The astronomical and magnetic work of the expedition was placed in special charge of Sergeant Edward Israel, who unfortunately was one of those not permitted to return, but whose records abundantly testify to his faithfulness and painstaking industry. Copies of these records in a highly condensed form were safely brought home, and were placed in the hands of C. A. Schott, assistant, coast and geodetic survey, for discussion and for preparation for the press. This task was rendered somewhat difficult from want of additional explanation on the part of the observer: fortunately Lieutenant Greely took the precaution, when retreating from his station in 1883, to bring with him the magnets and pendulum, thus permitting certain supplementary observations to be made at home. This cannot be too highly commended, when we consider that every pound of dead weight carried necessitated leaving behind so much food to sustain the life of the party on their perilous retreat. In judging of the merits of the labors of the expedition, it should be borne in mind that all efforts had failed to succor this party, which occupied the northernmost station assigned to any of the expeditions, and that, at the time of its sailing, certain magnetic instruments needed for fully carrying out the programme adopted by the international commission could not be obtained.

The magnetic observatory at Fort Conger was erected a short distance from the main house, and was supplied with a new magnetometer made by Fauth & Co. of Washington, and with a dip circle of the Kew pattern, but it had no differential instruments. The observations were made on Göttingen mean time, which differs 4^h 59^m from local time and 5^h 48^m from Washington time. A small transit, loaned by the survey, served for the determinations of time and longitude. The observations for time and latitude were made by means

of the sextant, and comparisons of chronometers were made throughout the stay of the party. From a series of observations of double altitudes of the sun (near lower transit), and of circum-meridian altitudes of the sun (upper transit), the latitude was found to be $81^{\circ} 44' 00'' \pm 5''.4$. The azimuth of the mark for absolute declination was determined on three days from observations of the sun with a theodolite, viz., $44^{\circ} 44'.3 \pm 0'.8$ east of south. The longitude of the station from Greenwich was determined by means of ships' chronometers on the outward trip, and at the station by observations of moon culminations, occultations, and lunar distances, with the result $4^h 18^m 53^s.3 \pm 1^s.2$ west of Greenwich.

The accuracy of this result is mainly due to a fine series of seventeen moon-culminations. In arc, the longitude is $64^{\circ} 43' 50''$ W., and the value preliminarily adopted by Lieutenant Greely for the use of his party was $64^{\circ} 45'$ W., on the authority of Lieutenant Archer, R.N., as the result by the British expedition to this place in 1875-76.

During the first ten months of the occupation of the post a series of hourly observations of the declination were made on three days in each month: this comprises the period from Aug. 1, 1882, to Aug. 31, 1883, and includes 846 observations, with a resulting declination $100^{\circ} 13'.6$ west of north. The results of the diurnal variation of the declination are stated as follows: on the yearly average the needle reached its extreme westerly deflection between 3^h and 4^h P.M. (local time), amount 45', and its extreme easterly deflection between 0^h and 2^h A.M. (local time), amount 40', hence the diurnal range $1^{\circ} 25'$. The diurnal variation is illustrated by a diagram.

The series of hourly observations of the declination at Fort Conger began with July 1, 1882, and ended with Aug. 1, 1883; this is the period which was assigned by the international commission to be that of close and simultaneous co-operative magnetic work obligatory on all parties. The differential measures of this series were converted into absolute values; the tabulation and discussion of this series constituted the greater part of the labor expended on the observations. The method of separating the so-called disturbances from the general record, and their treatment when separated, was left, apparently, by the Vienna conference to the discretion of each individual party, though several methods were proposed. It is well known that there is no certain criterion of what constitutes a disturbance, and, moreover, processes that may answer in lower latitudes will be found difficult of application for stations in high magnetic latitudes. It would take too much space to explain here this rather technical subject: it

may be sufficiently described, however, by stating that the mean deviation of an observed value from its respective hourly and monthly normal value was first made out. Then, according to Dr. Lloyd's rule, one and a half times this value, or, in the case of Fort Conger, $1^{\circ} 06'$ was considered the limiting value, and any observation differing by this or a greater amount from the normal value was designated 'a disturbance.'

These hourly normals and (larger) disturbances were tabulated and the results were discussed. The average declination from this series is $100^{\circ} 34'.5$ W., and when compared with the earlier result of the British expedition gives $9'.9$ as the most probable value for the annual diminution of west declination at this place. It is shown that the effect of the presence of these (larger) disturbances was to diminish the declination by $2'.3$, and that the diurnal range of the motion of the needle was increased by their influence.

The solar-diurnal variation of the declination is presented in tabular and analytical form as well as by a diagram: its most characteristic feature is the occurrence of the westerly extreme soon after local noon, with a deflection of $37'.9$, reached earlier in summer and later in winter. The opposite extreme is reached an hour and a half after midnight, with a deflection of $27'.9$, also found variable with the season. Average diurnal range, October to March, $0^{\circ} 56'$, and April to September, $1^{\circ} 22'$. In the annual variation of this average range, December exhibits the minimum of $28'$, and June the maximum of $1^{\circ} 48'$. The lowest reading on record was on Nov. 16, 1882, at 8^h 35^m A.M. (Göttingen time), when the declination was $92^{\circ} 51'.6$ W., and the highest reading on the day following at 10^h 20^m P.M. (Greenwich time), viz., $113^{\circ} 19'.8$ W., showing a change of no less than $20^{\circ} 28'.2$ within thirty-eight hours; and it is noted that a great magnetic storm was raging between Nov. 13 and Nov. 19, 1882, which culminated in intensity on the 17th.

The total number of hourly observations during the year was 8,749, and the number of (larger) disturbances separated from them, 1,169; in other words, there was one (largely) disturbed observation in every eight.

The distribution of the disturbances in the diurnal and annual periods, with separation into easterly and westerly disturbances, was then analyzed and the results were tabulated, with respect to both frequency and magnitude. But for want of space we cannot follow out all the results presented. We may, however, mention the following: during the year (ending Aug. 1, 1883), the easterly disturbances exceeded in number the westerly ones in the proportion of 661 to 508, or

of 1.30 to 1 : in the annual variation the disturbing force was most active during November and least during September. In the diurnal variation the easterly and the westerly disturbances follow different laws as to frequency and amount. The disturbing force deflecting the north end of the needle towards the (magnetic) east is most active two hours after midnight and least active during the hours 12 to 17 (or afternoon hours). On the other hand, deflections to the west appear most frequent three hours after noon and least about the hours near midnight. Respecting intensity of action, easterly disturbances slightly exceed westerly ones.

The term-day and term-hour observations extend over the interval from July 1, 1882, to Aug. 1, 1883. They were made on the 1st and 15th of each month, when the declination magnet was observed every five minutes throughout the twenty-four hours, simultaneously at all stations taking part in the research. Besides these, observations were made every twenty seconds during one selected hour on each of the term-days. The labor bestowed upon this part of the work was very great, but it is expected that correspondingly valuable results may be deduced by their inter-comparison after all the expeditions shall have published their observations. Not content with these labors, the magnetic observers also recorded the motion of the needle during magnetic storms and in connection with appearances of auroras.

The usual observations of oscillations and deflections were made for the determination of the magnetic intensity : the record and computations are given in detail and the results are tabulated and expressed in British, Gaussian, and C. G. S. units, or dynes. For the epoch 1882-84 the horizontal component of the magnetic force was found 1.118 British units, or 0.05155 dynes, and it would appear from comparison with the results found by the British exploring expedition, 1875-76, that this intensity did not undergo any perceptible change during the interval. The tabular values show extreme variations of about one-fiftieth part of the force.

Hourly observations of the dip were made between Sept. 25, 1882, and June 1, 1883. These were in a measure differential, and resulted in an average dip of $85^{\circ} 01'$. Combining with the horizontal component, the total intensity as observed at Fort Conger becomes 12.870 British units, or 0.5934 dynes, for the epoch 1882.2. By comparison it was found that the dip had been increasing since 1875-76 at an annual rate of $1'.6$.

The dates of auroral displays are next enumerated, and extracts are given of the character of the more imposing auroras. Then follows a table

of magnetic results, collected during explorations by different parties, and extracted from Lieutenant Greely's narrative. The paper concludes with a general collection of magnetic results obtained from the expeditions of Kane, 1853-55, of Hayes, 1860-61, of Hall, 1871-73, of Nares, 1875-76, and from Lieutenants Crosby and Seabee of the Bear and Thetis in 1884. From these observations it is concluded that for the last twenty-five years, at least, the magnetic west declination has been annually decreasing about $6'$ in the region of the North Water, Smith Strait, and Kane Basin, and that in the region to the north of it, and including the Hall Basin, this decrease was fully $10'$ per year during the past decade.

In close connection with the scheme of physical researches undertaken by the International arctic committee, the desirability of a new determination of the American pole of dip does not appear to have been urged. It must be admitted that the region is difficult of approach ; yet the gain to our knowledge of terrestrial magnetism and its secular changes would be very certain if it could be successfully explored. More than half a century has elapsed since Ross made his memorable and bold dash to this point, but science nowadays will demand more, and the whole region in that vicinity would have to be surveyed in order to permit the tracing out of isoclinics or the application of a suitable analytical process to bring out the facts of the case, as, in consequence of local deflections, there may be many points of vertical dip covering or distributed over a considerable area.

From the time of Hansteen, early in this century, to the present time, efforts have been made to trace out the supposed motion of the intersection of the so-called magnetic axis with the surface. While some physicists hold it to be fixed in position, others believe it to have a slow secular motion of limited extent, and still others would give it a rapid motion with a path which will carry it clear round the geographical pole.

The time has certainly arrived when in this matter facts should take the place of speculation. The writer has the assurance of the willingness of three distinguished American Arctic explorers to undertake this task, only the one thing lacking is the necessary funds to sustain the explorer, say for two years.

There is surely here a fine field open in which to gain well-merited distinction. C. A. S.

A NEW departure has been made by the U. S. coast survey by way of experiment, in the publication of a chart on Mercator's projection, extending from New York and embracing Nantucket shoals.

COMPARATIVE TAXATION.

IN the last of two articles, entitled the 'Relative strength and weakness of nations,' which appeared in the February number of the *Century magazine*, Mr. Edward Atkinson treats of the burden of taxation in various countries, and makes an estimate of the "relative proportion of the assumed product per capita which is absorbed by national taxation only." It will be noticed that Mr. Atkinson confines himself to national taxation, including under that head, presumably, the taxes of the individual German states, as well as of the empire. Such a comparison may be of value, but it is evident that it can afford no criterion of the comparative burden of taxation in the various countries unless national taxes should form, approximately at least, a like proportion of the total taxes in each. As a matter of fact, the relative proportions of national and local taxes vary greatly with the different countries, local taxes being a much more important element in the United States than in the countries of Europe. In the latter, especially in the case of such centralized governments as that of France, revenue derived from national taxation is employed for purposes which here come under state or local jurisdiction. Therefore, though we should admit, as Mr. Atkinson maintains, that national taxes absorb a smaller proportion of the product in this than in other countries, it would by no means follow that the burden of taxation was lighter in the United States than in European nations. Mr. Atkinson would nowhere seem to affirm this conclusion, but his statements are misleading, from the fact that he neglects the consideration of the very important element of local taxation, — the only reference to the question tending to add to the wrong impression, — for he says, in speaking of what proportion of the total product is left to the producer after the deduction of national taxes, "In considering these remainders after national taxes have been set off, it must be borne in mind that municipal taxation as well as profits doubtless take a larger proportion in the poorer countries than in the richer ones."

In addition to his neglect of local taxation, Mr. Atkinson appears to have made another important oversight in failing to take into consideration the difference in the methods of obtaining revenue which exists among the various countries. In the United States, government depends almost entirely upon taxation for its support, but many of the European nations derive a considerable portion of their revenue from the profits on public undertakings, such as the telegraph, railroads, public domains, mines, etc. In the *Deutsche Rundschau* for January, 1885, Professor Richard von Kauf-

mann makes the following estimate of the proportions of receipts which come from taxes in the countries mentioned: —

	Percentage of receipts from taxes.	Percentage of receipts from other sources.
Germany (empire and states)...	41	59
Italy.....	69	31
Austria-Hungary.....	71	29
Russia.....	79	21
Great Britain.....	82	18
France.....	88	12

Mr. Atkinson appears to have substituted total revenue for receipts from taxes, for otherwise it is impossible to understand how he can have obtained the figures which he gives. He estimates the per capita national taxation in the countries given as follows: United States, not over \$6; Italy, \$10.42; Holland, \$10.90; Belgium, \$11; Great Britain, \$11.80; Germany, \$12; France, \$18.

It is interesting, in comparison with the above, to make an estimate taking into consideration local taxation and the distinctions in the sources of revenue, which will show the average per capita tax paid by a citizen of New York and Berlin respectively for all purposes, local, state, and national or imperial. The following statement is based on the 'Almanach de Gotha' for 1886, a statement of the Berlin budget for 1886-87 which appeared in *Bradstreet's* for March 20, 1886, and the report of the comptroller of the City of New York for 1884.

While these sources do not correspond exactly in time, they will afford results very nearly true. The per capita national tax in the United States, which Mr. Atkinson says does not exceed \$6, is placed at \$5.50, and the population of New York is estimated at 1,350,000. In Berlin the taxes are as follows: —

Imperial tax (exclusive of state contributions).....	\$ 2.03
Prussian tax (including contribution to the imperial treasury).....	3.44
City tax.....	5.35
Total.....	10.82

The owner of a house connected with the sewage system is charged one per cent on the income from the house, which payment amounts to about

thirty-five cents per capita. In New York the taxes are as follows :—

United States tax.....	\$ 5.50
City tax (including state tax).....	19.92
Total.....	25.42

The citizen of New York pays nearly two and one half times as much as does the citizen of Berlin.

Mr. Atkinson estimates the per capita product of the United States at \$200, and that of Germany at \$100 ; thus, although no estimate on a question of this kind can make any pretensions to accuracy, on the basis adopted by Mr. Atkinson, not only a larger amount per capita but a larger percentage of the product is absorbed by taxation in New York than in Berlin. The reason is that in Germany the city and state together derive more than half of their revenue from the profits of productive undertakings, and by superior methods of administration have greatly reduced the cost of government.

In Berlin, out of a total revenue of \$13,754,593, only \$7,042,014 comes from ordinary taxes. The profit on public works, particularly the gas and water works, amounts to \$1,325,419 in excess of payments made for the amortization of and interest on the first capital. Payments of a percentage of gross receipts by such private monopolies as street-railways and gas-companies are other sources of revenue, as is also a charge of \$23.80 for scholars in the higher schools. Payments by monopolies and scholars are taxes, yet they do not bear upon the citizens in general in any thing like the same proportion as do ordinary taxes, and, in a question of the burden of taxation, distribution is a very important factor. The neglect of the local element must also cause us to question Mr. Atkinson's conclusions in regard to the comparative amounts of debt. For instance, he places the per capita debt in the United States, including state debts, at \$27, and in Germany, including kingdoms and duchies, at \$39 : but the debt of New York on Dec. 31, 1884, was \$126,871,138, or \$94 per capita, while that of Berlin is \$36,965,767, or \$28 per capita ; and in addition to this it must be remembered that in Germany both states and cities own large amounts of productive property, the value of such property, in the case of Prussia at least, being more than equal to the state debt.

While it would not be fair to argue from the comparative condition of New York and Berlin to the comparative condition of the United States and Germany as a whole, still the city, as a centre of production, is an element of great and growing importance, and in estimating the comparative burdens upon producers in this and other coun-

tries more valuable results will be obtained by considering those who work, as near as may be, under the same conditions in the various countries, than by taking the average for whole populations.

The figures for other countries than Germany are not at hand, but the same considerations would modify Mr. Atkinson's results in all cases, though probably to a less degree than in Germany.

The neglect of these three points — local taxation, profits from public undertakings as a source of revenue, and administrative methods as an element in the cost of government — has in large measure destroyed the value of Mr. Atkinson's work as a comparative study.

HENRY B. GARDNER.

A DISCUSSION ON ARSENIC POISONING.

A VERY interesting and instructive discussion took place at a recent meeting of the Suffolk district medical society on the subject of poisonous arsenical wall-papers. Dr. J. R. Chadwick described an experience which he had in his own family, in which his two daughters suffered from dyspepsia, colicky pains, and headaches, which disappeared when they left the house for the summer, and re-appeared on their return. He found that the wall-paper in the nursery was very arsenical, although, having previously suffered from this same cause, he had made special effort to obtain paper free from arsenic, and had been assured by the dealer that a chemist had analyzed it and pronounced it free from arsenic. During the discussion which followed, many cases of sickness were reported as having been caused by arsenic in wall-paper. Professor Hill of Harvard university said that he was the examiner for two of the most prominent paper-houses in the state of Massachusetts. During the period from 1879 to 1883 the percentage of arsenical papers was from fifty-four to sixty-five of all papers examined. In 1884 it had fallen to forty-seven per cent, and in 1886 to thirty-three per cent. Only thirteen per cent contained any thing more than a trace of arsenic. In reference to the law which had failed of passage in the legislature, limiting the amount of arsenic to one-fifth of a grain in the square yard, he thought our knowledge of the limit which it is safe to establish was too indefinite. A law to prevent the sale of 'rough on rats' would save more lives than a law to prohibit the sale of wall-papers containing a trace of arsenic. Professor Wood of Harvard university thought the chief danger was from the dust which is constantly being given off from the paper, and which is contained in the air of the room, by which it comes in contact with the

eyes, nose, and throat. Professor Hill of Cambridge considered that the idea of establishing a limit to the degree to which arsenic may exist in wall-papers was faulty, from the fact that there is no reason for the use of arsenic at all in the manufacture of wall-papers. Colors can now be obtained which are free from arsenic as an impurity, and those colors should certainly be employed in all papers. Dr. Chadwick offered the following resolution, which was unanimously adopted: "*Resolved*, that it is the opinion of this meeting that the clinical evidence already adduced in this and other countries establishes beyond doubt the fact that arsenical wall-papers will, in many instances, produce symptoms of poisoning by arsenic in persons occupying the rooms whose walls are covered by such papers."

THE MEDICO-LEGAL ASPECTS OF HYPNOTISM.

A. BINET, one of the leading French authorities on hypnotism, has written an appreciative but critical notice of the work of Campili that gives an excellent view of the French and Italian standpoints regarding this subject that is assuming so much importance there. Dr. Campili has had the advantage of numerous memoirs in France and elsewhere. M. Legeois has shown the possibility of making the hypnotic suggestion serve a criminal purpose, but has not discussed the subject. MM. Binet and Féré set themselves to determine the conditions under which the reality of the hypnotic suggestion may be admitted by a tribunal—the judicial proof, in other words. Dr. Campili presents the problem from the point of view of the two schools of criminologists in Italy, the classical or spiritualistic school, and the anthropological school, which differ not only in their theoretical conceptions but also in their practical conclusions upon the application of punishment. Upon the question of hypnotism, however, the two schools admit the same conclusion. Dr. Campili examines what the civil and penal responsibility of the hypnotized subject is when criminal acts have been committed or obligations have been assumed under the influence of a hypnotic suggestion. According to the classical legal school, the hypnotized subject is not responsible, since he has not committed a voluntary and conscious offence: there can be no punishment where there has been no fault. The anthropological school, which does not assume this subjective point of view, but considers that the judicial institutions have the simple function of social preservation and

defence, arrives at the same conclusion, but by a different way. In a very detailed discussion the author arrives at the conclusion that the needs of social defence only demand the repression of criminal acts when these are the expression of the personality of the agent, and since in the hypnotic subject the individual reaction is abolished, the acts that he does under the influence of a hypnotic suggestion are simply those of an automaton. These conclusions are at least debatable, says Binet, and rest on premises that contain an error of fact. The belief is too common to-day that it is possible to characterize the psychical state of hypnotism in a single word and say it is a condition of automatism. In a vast number of cases the subject preserves his intellectual and moral identity: when he receives a suggestion to act, he may resist if the act is in contradiction with his character, and he may examine the order and even absolutely refuse to obey. Campili seems to have seen this difficulty, for he recalls that in an ingenious article M. Bouillier has admitted a moral responsibility in dreams, but he meets this objection with an argument of little weight, that the hypnotized subject does not preserve his personality in the same way that a sleeping person does.

Binet holds, on the contrary, that the closest connection exists between the effects produced by suggestion and the state of dreaming. The hypnotic suggestion is nothing else than a dream produced and directed by assistants. In fact, the somnambulist is not an automaton, he is an *individual*, and, from the purely theoretical and moral point of view, he may be held partially responsible for his acts. These conclusions are in direct accord with those of M. Bouillier.

But what is the practical point of view? Has or has not society the right to defend itself against the crimes of hypnotism? Will it suffice for the assassin to show that he was under the influence of a suggestion for the judges to grant him his liberty and allow him to begin his work again? Clearly a uniform toleration is out of the question. Until recently hypnotism figured only accidentally in judicial proceedings, but now all this is changed, and hypnotic suggestion may readily enter into criminal proceedings. This is exactly what has happened in Turin, where, says Lombroso (*Revue scientifique*, June 19, 1886), there is a veritable epidemic of hypnotism. Society must protect itself against such a danger. Garfalo, in his remarkable work on *criminologie*, argues that we must apply to the criminal who has committed a punishable act in a state of hallucination or of somnambulism the same treatment that we give to those who have committed a crime in an epileptic or hysteric attack or from

Il grande ipnotismo e la suggestione ipnotica, nei rapporti col diritto penale et civile. By G. CAMPILI. *Revue philosophique*, October, 1886.

the effect of impulsive mania; that is, seclusion in a criminal asylum for an indefinite period until a complete cure is established, or until the patient passes into some other condition that renders a repetition of the act an absolute improbability. Campili thinks that it would be difficult to apply the same punishment to an hypnotic criminal, since he did not commit the crime of his own accord but under the influence of a third person, who is the true culprit: the hypnotic subject is simply an instrument of crime in the hands of the hypnotizer the same as a revolver or a knife, and it is he who ought to bear the responsibility of the act. This is a subtle distinction. The hypnotic subject, like the epileptic, is a dangerous person, a veritable *malade*, since he allows a very simple manoeuvre to make him commit a crime. It is absolutely necessary to put him beyond the possibility of doing harm. Moreover, it is probable that the dread of punishment exercises a restraining influence over the minds of those who submit voluntarily to be hypnotized: in fact, Binet holds, many persons who are slightly hypnotizable may resist hypnotization successfully, and ought to be responsible for consenting to submit themselves to the experiment. There is the strongest reason for this conclusion if the subject knows in advance, before going to sleep, that a criminal suggestion will be given to him. There is one curious hypothesis that Campili has not anticipated, and one which well-known facts render extremely probable, and that is that we may find some day in some band of thieves or assassins a hypnotic subject who of his own accord yields himself to criminal suggestions: the usefulness of hypnotic suggestion under such circumstances is easily understood, for those who are under the control of a suggestion have more audacity, more courage, and even more intelligence, than when they act of their own accord. There are patients who, dreading to be put to sleep by some one that they dislike, offer to the hypnotic suggestion of one of their friends a power of resistance that they do not have naturally. Others, wishing to accomplish some act, and fearing that their courage will fail at the last moment, suggest themselves the act that they wish to do. In these circumstances the subject should be punished as the principal and the hypnotizer only as an accomplice.

The Paris correspondent of the *Medical record* writes last December that an epidemic of hypnotism prevails there, and he paints the prevailing distemper in exceedingly dark colors. Every steamer brings some new book on hypnotism or mental suggestion, and the amount of literature that has accumulated within the past year is enor-

mous. Public exhibitions of hypnotism have been interdicted in Germany, Italy, and Austria. This is but one side of the shield, however, and brilliant therapeutical results have been reported by the skilled coterie of French physicians that has advanced our knowledge of hypnotism so much within the past few years. Yet on the whole, perhaps, it is a matter for congratulation that the more stolid American mind has been little affected by hypnotism up to this time, not even to the extent of furnishing sufficient subjects for the Society for psychical research. It may be that the 'mind-cure' is our cross, and at any rate the connection between this and hypnotism offers a promising field to the investigator.

WILLIAM NOYES.

PALEOLITHIC MAN IN LONDON AND ITS NEIGHBORHOOD.

EVER since Dr. John Evans, in the year 1860 (*Archeologia*, xxxviii. 301), showed that the object was a genuine paleolithic implement of the Chellean type, which, under the disguise of 'a British weapon found with elephant's tooth near Gray's Inn Lane,' had been lying for years unnoticed in the British museum, a peculiar interest for prehistoric archeologists has attached to the quaternary gravels of the valley of the Thames. This noteworthy implement seems to have been discovered some time at the close of the seventeenth century, and an account of it, illustrated by a rude engraving, had been printed so early as 1715. Consequently the city of London may lay claim to be the site of the first recorded discovery of the earliest implements of mankind. Similar discoveries have continued to be made in different parts of the valley of the Thames, especially in that portion of it lying within the county of Middlesex. Mr. Worthington G. Smith, in particular, published in the *Journal of the anthropological institute* accounts of finding paleolithic implements in the little tributary valleys of the Lea and the Brent. But in 1883, after five years of patient research, he made known the interesting discovery (published in the same journal, xiii. 357) of a 'paleolithic floor at North-east London.' He showed that a stratum of worked flints of the paleolithic age lay spread for many miles a few feet beneath the present surface of the ground. The majority of the implements contained in it were found at the height of about seventy-five feet above the present level of the Thames. "As a rule," he says, "every implement and flake is as

Paleolithic man in north-west Middlesex. The evidence of his existence and the physical conditions under which he lived at Ealing, and its neighborhood, etc. By JOHN ALLEN BROWN. London, Macmillan.

sharp as it was on the day it was made." The best section of this 'floor' was at Stoke Newington Common, where there was found, about four feet below the surface, an immense accumulation of paleolithic implements, of both the pointed and oval types, numerous scrapers and hammer-stones, with cores and flakes innumerable.

Mr. J. A. Brown has been prosecuting similar researches in the north-western part of London, and has discovered in the high-level gravels at Acton 'a paleolithic workshop site,' in which some five hundred or more of such objects have been found at a depth of six feet below the surface. "The whole of the specimens," he says, "are as sharp as when they were flaked off from the cores, and it is clear that they have never been removed from the spot, where they were left by the paleolithic people, who made them, when they retreated before the advancing waters" (p. 57). The present volume, embodying the substance of several papers read before various scientific bodies, contains an interesting narrative of his own investigations, and those of other explorers, and is profusely illustrated by engravings of specimens of all the different objects which have been found by Mr. Worthington Smith as well as by himself. But Mr. Brown has also availed himself of the opportunity of compiling from many sources an extended study of the condition of certain savage races, for the purpose of illustrating the probable mode of life, conditions, and culture of the river-drift men. With one of his conclusions, however, I feel constrained to differ. From what seems to be very insufficient evidence he has drawn the inference that the paleolithic man 'had invented or used the bow and arrow.' His reasons for this opinion, so much at variance with that held by most prehistoric archeologists, are that he has found a few small triangular flakes which he styles "the earliest form of arrow-head," and thinks they "could hardly have been used in any other way" (p. 72); and also other flakes having on one side "worked hollows, which are generally regarded as shaft-smoothers" (p. 116).

Now Mr. O. A. Shrubsole, in an article on 'Certain unfamiliar forms of paleolithic implements' (*Journal of the anthropological institute*, xiv. 196), has argued that man in a primitive state, having only natural forms of growth to avail himself of, such as wood, bone, or horn, would of necessity fashion tools for scraping-purposes, with curved outlines; and to me it seems unreasonable to restrict similar implements to the sole purpose of 'shaft-smoothers' for arrows. Mr. Worthington Smith has reached the conclusion that the makers of the implements, which he has discovered in

such abundance, "depended for food upon roots and wild plants, and the bodies of small animals slain by stones thrown from the hand;" and he does not believe that the objects found by him were intended for weapons, but for tools. Mr. Brown's rejected hypothesis, that the small triangular flakes, which he has figured, if indeed they are implements at all, were used as 'points of small harpoons for killing fish' (p. 117), seems much more probable, than that the paleolithic man, as I have attempted to show elsewhere (*Proceedings of the Boston society of natural history*, xxiii. 269), should have invented such an ingenious and complicated instrument as the bow and arrow.

HENRY W. HAYNES.

RIDGWAY'S NOMENCLATURE OF COLORS AND COMPENDIUM.

EVERY naturalist has doubtless at times seriously felt the need of some means of identifying the various shades of color he is called upon to designate in describing animals or plants, or interpret in the descriptions given by other authors. No standard work, duly illustrated, having this end in view, has for many years been available. This want Mr. Ridgway has now attempted to supply. His 'nomenclature of colors' comprises fifty-eight pages of text and ten colored plates. A brief discussion of principles of color is followed by a chapter on the selection of pigments and their combination to produce required effects, and a comparative or polyglot vocabulary of colors, in which is given the equivalent terms in seven languages of more than three hundred designated shades of color. About one hundred and seventy of these shades are defined and illustrated by the plates, and their composition indicated by explanatory text. This forms part i. of the little manual under notice. Part ii. consists of an 'ornithologists' compendium,' devoted mainly to an extended glossary of technical terms used in descriptive ornithology, illustrated by six outline plates, relating to the topography of a bird, the forms of feathers, the patterns of color-markings, and the contour of eggs.

Mr. Ridgway has thus not only attempted to fix and illustrate a standard nomenclature for the "numerous hues, tints, and shades which are currently adopted, and now form part of the language of descriptive natural history," but has brought together a most convenient mass of technical information of great importance to ornithologists, whether specialists or amateurs.

A nomenclature of colors for naturalists, and compendium of useful knowledge for ornithologists. By ROBERT RIDGWAY. Boston, Little, Brown & Co. 8°.